CALIFORNIA STATE UNIVERSITY, NORTHRIDGE

PHOENIX MISSILE FLIGHT TEST AND DATA BASE

A Graduate Project submitted in partial satisfaction of the requirements for the degree of Master of Science in

ENGINEERING

by

Mark James Bergen

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The graduate project of Mark Bergen is approved:

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Committee Chairperson

California State University, Northridge

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ABSTRACT

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The following publication documents work accomplished in the areas of (1) designing a program to store and retrieve launch data for the PHOENIX missile and (2) preparing a Flight Test Plan, monitoring the test, and writing the Final Launch Report for a PHOENIX AIM-54A missile. A basic computer program incorporating string variables was compiled to be used in conjunction with the Hewlett-Packard 9830A programmable calculator for the purpose of storing variable strings into data files on a magnetic cassette tape. A complimentary program was devised to recall and print out all or portions of selected data strings. A documented listing of all programs involved is enclosed.

A brief description of the F-14A/AWG-9/AIM-54A weapons system as it applies to Flight Testing of the PHOENIX missile is given, followed by a short introduction to the task of writing a Flight Test Plan for Performance Verification Launches, PVL-14, -15, -16, -17, -18, and

subsequent Flight Test and Final Launch Reports conducted and written for Operational Evaluation mission E-4.

INTRODUCTION

On November 10, 1974, a Job Order Specification was submitted for a Technical Professional Work Assignment with the PHOENIX Missile Group of the Fighter Weapons Branch, Test Operations Department of the Naval Missile Center, Point Mugu. At this time, the work assignment as specified in the Job Order Specification (JOS) consisted basically of two parts: (1) to design, develop and document a computer program for storage and retrieval of AIM-54A (PHOENIX Missile) test data; and (2) prepare a flight test plan, assist in the conduct of the launch and write the initial, final and summary launch reports in support of the AIM-54A Performance Verification Launch program. The first objective has been met and is documented in this project report. To meet the second set of objectives, a Performance Verification Launch (PVL) was assigned, PVL-16. Under this launch assignment, extensive research was done and a detailed Flight Test Plan was written. But, because of funding problems, the flight test was not conducted. In lieu of the PVL-16 brief, debrief, initial and final reports, experience with various Operational Evaluation (OPEVAL) and Naval Flight Verification (NFV) tests were substituted. In partial satisfaction of the second set of objectives, an OPEVAL

brief and launch was attended, and the final launch report written (Final Flight Test Report of OPEVAL E-4).

This report then attempts to document and assess the work completed in satisfaction of the original work assignment as described in the JOS of 13 November 1974.

PHOENIX DATA STORAGE PROGRAM

Background

On 3 October 1974, the problem of developing a data base for PHOENIX missile launches was introduced. This assignment came as a result of three factors; (1) A new job assignment was needed as the current VTAS (Visual Target Acquisition System) fly-off program was facing budget problems and schedule slippage; (2) the new job assignment would provide experience with the types of data obtained from PHOENIX launches, which would in turn provide a good introduction to an inevitable job reassignment currently being developed; and (3) the need for a data base did exist due to the continuing requirement for data from past launches to support report writing, defining problem areas, etc.

The initial requirement was to design a computer program for the Hewlett-Packard 9830A programmable calculator that would print out AIM-54A missile data from those launches that fit a given set of input restrictions. As an example, the program should be flexible enough to allow the user to require a complete or partial list of missile data for those launches that fit a set of several criterion (i.e., for air launches conducted above 20K FT, at speeds of more than 900 knots, etc.).

The HP-9830A was selected because of its availability and ease of operation. The HP-9830A available for this assignment has a useable memory space of 3808 (16-bit, two-byte) words, uses BASIC as its programming language, and is combined with a thermal printer (HP-9866A Printer) capable of printing 80 characters per line, 240 lines per minute. It can also store (and read) programs, as well as data, onto (and from) a magnetic tape cassette. The last important feature to be mentioned is the capability to recognize and to operate on letter and word strings or string variables (for more information on the Hewlett-Packard 9830A, see reference (1)).

Designing the Program

On 10 October 1974, the technical director specified the proposed table of pertinent data to be stored for each launch. In addition, a set of twenty-four banks of launch data was presented as a sample set of data to be used in the program development. The longest entry for each of the thirty-six original data headings was assumed to be the maximum allowable space provided for the respective heading. A quick calculation of the number of characters the printer would allow per data heading if launch data were printed in rows, produced two characters per heading (as the maximum number of characters that may be printed per line from a print statement is seventy-two). This new constraint dictated that the launch data would be printed out in columns. The nature of the data (a mixture of

words, letters, abbreviations and numbers) also confined the method of storing data to string variables. Since only 255 characters may be stored per variable string, careful attention was given to the maximum allowable space per data heading in all strings. The final allocations can be seen in Appendix A (each dash following the data heading allows one character). It was also envisioned that the headings would be printed on the left side of the paper for each group of launch data. A string was then comprised to hold all of the characters necessary for a complete list of data. Since the headings alone filled one string, a second string was designed to hold the heading units. Then the maximum number of data columns per page was determined by first finding the largest sum of the heading and 1/2 (corresponding data length). This then gave the centerline of the first data column as:

(1/2 (number of data characters) + number of heading characters, or the number of characters required for heading and heading units)$_{max}$ + 2

where two spaces were to separate the data from the heading title. Given the centerline of the first column and the maximum length of data to be allowed, it was determined that four columns of data could be accomodated per page given by the relation:

$$22 + 6 + (14)\ X = 72$$

where X = one less than total number of data columns per page

22 = number of characters of (heading and half data line)$_{max}$

6 = half of maximum data line

14 = maximum data line length and 2 spaces for separation

72 = total maximum line length

Once the format of the printout was decided, the first part of the program was constructed (refer to Appendix D.) In what was to become two separate programs, a one dimensional matrix was initialized in seven separate groups. Through a compromise of convenience and necessity, it was decided that the user would have the option of selecting any combination of six of the seven available groups of data (i.e., launch parameters, relative data, missile data, fuze functions, and comments). The Mission Date, Mission Title, Fighter Type/Number and Missile Number formed the only group that could not be deselected, as it was felt that these bits of data comprised the minimum data requirement. The method used to initiate initialization of the one dimensional matrix, A, for a particular data group was by displaying a question and simultaneously requesting an input into string A$. This was accomplished by a display command followed by an input command, such as:

```
DISP "DATA";
INPUT A$
```

where the semicolon in the display command allows whatever

is enclosed in quotes to remain on the display (followed by a question mark) until the input is acted on by the user. Once an input is made, the string A$ is compared to the substring "no" in an if statement:

if A$ = "no" then (line number)

This is accomplished by comparing string A$ and substring character by character (by comparing the octal codes of each character, see Appendix A) until either a difference is found or all of the characters in both strings have been compared favorably. If a group of data is requested (in this manner) by the user, the one dimensional matrix, A, is subscripted by a counter, I, and in turn stores numbers in sets of four. The numbers stored into the one dimensional matrix, A, form two pairs of subscripts which then specify corresponding substrings in the heading and data strings (refer to computer printout in Appendix D). The two pairs of subscripts are:

W$ (A (I), A (I+45)); M$ (A (I+90), A (I+135))

(See Appendix D for program listing). At this time, a program was written that would determine the groups of data to be printed out as described above. The data manipulation portion of the program was then given careful consideration. Since it had been known that string variables were to be used, a COM (common) and DIM (dimension) statement would have to be used to allot space in memory for the matrices and strings used in the program. The size of the program dictated that it be broken up into at least

two separate programs. Since the first program initialized the one-dimensional matrix A to be used to print out the data in the second program, the second program had to be linked to the first (by the Link command). The Link command retains in memory all variables and their values introduced by the previous program while loading a second program from the magnetic tape (it also automatically runs the new program). The fact that the second program was to be linked then dictated that the COM and DIM statements were to be introduced in the very first program. Using the COM statement requires that it be the first line in the first program entered into computer memory if the succeeding programs are to be linked to that program. The dimension statement is usually all that is required to allot memory space for strings and matrices, but because it was required that data strings be retained in memory while a file of data strings was to be entered, the COM had to be used in conjunction with the DIM statement. For example, if four data strings could be printed out at one time, it would be necessary to be capable of retaining three residual data strings while entering another data file, thus insuring that each printout would contain four data strings with the possible exception of the last group printed out (consisting of four or less remaining data strings). The COM statement therefore contained all of the data strings. The residual strings and all matrices were to be in the DIM statement. Only one COM statement

may exist in any program so the maximum number of data strings that could be loaded from a data file (and consequently stored onto a data file) was limited to the number that could physically fit in a COM statement. This number turned out to be nine data strings, which when combined with the required three residual strings, etc., used an excessive amount of memory. Eight data strings were then designated as the maximum amount of data to be stored on each data file. Due to the amounts of memory required by the COM and DIM statements, the first program was split into two parts and linked together (See Appendix D for final program list).

Data Manipulation Program

Given subscripts for both data and labeling strings, the remaining problem was that of selecting the data strings to be listed and then listing them. Since the method of storing and retrieving data had been decided, the remaining problem reduced to that of basic programming. The method employed is shown in Appendix D in the program list. The design of the program is such that the user is asked for the number of constraints to be imposed, then is instructed to edit a series of "IF" statements corresponding to the number of constraints desired. If, for instance, two constraints are to be imposed, the sentence: Press (stop), then enter your constraints in line (s) 450,470 then press (cont), (2), (0), (0), (execute);

would be printed. The user is then given twenty-three seconds to act on that command. To aid in the editing process, a set of instructions are included in written form as well as being permanently stored on another magnetic tape labeled data program instructions, (see Appendix B). The instructions aid the user in editing "IF" statements in the program to hold his/her constraints. The constraints when entered are used only once as they are not permanently stored on the magnetic tape. The program then loads a data file and inspects each data string, if constraints were entered. A counter is employed and each good string is transferred to strings W$, X$, Y$ the fourth string remaining in Z$. These four strings are then printed out and the counter is reset back to zero. If less then four strings are found that satisfy the input constraints, the good data strings are stored in strings W$, X$, Y$ and the next data file is loaded in an attempt to complete the four string requirement. When each data file is loaded the H$ string is compared to the substring "zip". If this substring is found in H$, the remaining good strings are printed and the program is terminated. The substring "zip" indicates that the previous data file was the last file containing useable data therefore signaling the program to print out the remaining good data files. Instructions for operating the recovery programs were developed as shown in Appendix B.

Data Storage Program

At this time, the data storage program was developed (see Appendix C for program listing). When run, it asks for the number of the last data file entered (written on the back of the cassette tape) then loads that data file. After comparing data strings to empty substrings the last string to contain data is located and a counter, I, is initialized so that the next data string (after the last full data string) will receive the input data. Questions are then displayed and the number of characters allowed in the reply is indicated. When the string has been filled, the operator is asked if another string is to be stored. If the answer is not "no" the system is recycled and allows the user to enter another string of data. If the counter indicates that eight strings of data exist, all data strings are stored onto a data file and the user is asked if more data is to be stored. The program is recycled until the user answers "no" to the inquiry "want to store another string?"

Instructions were developed for this storage program and stored on the instruction tape. A written copy of the instructions for both data storage and data manipulation are kept with the cassette tape. (see Appendix B for instructions).

Results

Due to late revisions in the print out format, data

has had to be re-entered four times. Currently data from eighteen PHOENIX launches have been stored on magnetic cassette tape. Several successful data listings have been made by three of the four intended users. In Appendix E, communication exchanges between computer and user can be seen for three data acquisition attempts. For the given examples, six dummy data strings were created and manipulated as shown in Appendix E. In the first data print out, the user is asked two questions; "Do you want all of the data?" and "How many constraints do you want?" In this case a complete list of all the data in memory was required therefore the replies were "yes" (all data desired) and "Ø" (no constraints imposed) respectively.

In the second example the user requires data for only those launches where the AIM-54A was launched from an altitude, greater than or equal to 27.31 KFT. Since the user indicated that all data was not desired, the computer then determined which of the possible six groups of data were to be de-selected by asking the user six yes or no questions. As indicated in the example, a negative response has to be NO, as any other possible group of characters will enable the computer to assume a positive response. One constraint was also asked for and consequently a set of basic instructions were printed out that enable the user to edit the appropriate "IF" statement. A set of editing instructions available to the user then directed the user to press: (fetch), (4), (5), (0),

(execute). This command calls the line holding the appropriate "IF" statement to be edited. The available instructions (see Appendix B for instructions for the data recovery program) then allowed the user to create an "IF" statement given that launch altitude in KFT is identified by Z$ (33,37) = "27.31", the program is then continued from line 200, as directed by the printed command and the result is as shown.

In the third example, only a brief list of available launch data is desired so the user asks for no data and no constraints and receives only; "MISSION DATE", "MISSION TITLE", "FIGHTER TYPE" and "MISSILE NO.". This data is then considered to be the minimum data to be received and therefore can never be de-selected. Two methods were devised to create constraint "IF" statements. The first method is to be used when searching for or comparing numeric answers only. Example:

VAL (Z$ (33,37)) = 23.0

This method determines the numeric value of the sub-string Z$ (33,37) and compares the given value to 23. If Z$ = "23 ABC" then the "IF" statement would be satisfied. If however Z$ = "ABC 23" the "IF" statement would not have been satisfied as the first character must be a digit, decimal point or E-notation.

The second method requires an <u>exact</u> match between two sub-strings as each character is compared character by character until a difference is found (by comparing the

actual codes of each character). Example:

Z$ (33,37) = "ABCDE"

IF Z$ (33,37) equals " ABCD" then the statement would not have been satisfied as the octal value of a blank space is found to be 040 as compared to 101 for "A".

There are possible improvements that could be incorporated into this program. The first being that when storing data, editing instructions were not provided for so that any mistakes made when storing data cannot be easily corrected. The options open at this time in that situation are (1) to turn the calculator off and re-enter all the data (possibly up to eight strings), or (2) store the string as it is and have a more proficient programmer edit the data strings at a later date. It was felt that editing instructions to cover all of the possible mistakes imaginable would have been too time consuming and complicated to follow, therefore this alternative was delineated.

The second possible improvement is in the method employed to enter constraints. For a non-programmer the editing process would be complicated to say the least, but to make constraint entering possible in English would have necessitated an exorbitant amount of computer memory. After consulting the technical director about the options open it was decided that an "IF" statement constraint would suffice and consequently became an integral part of the program.

After several users worked with the program, it was confirmed to be a usable data storage and recovery system and is thus currently in use.

PHOENIX FLIGHT TESTS

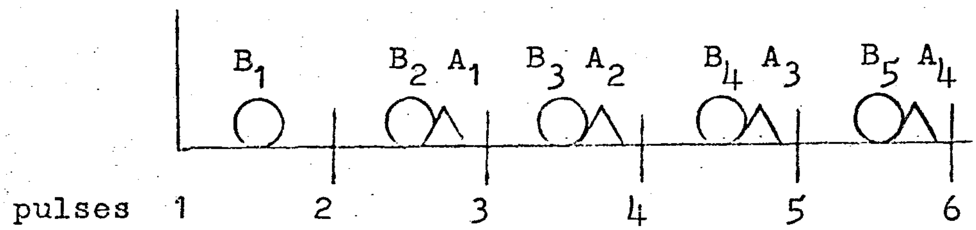
On 25 November 1974, the Data Storage Program was completed and verified. At this time preparation was made to facilitate familiarization with the F-14A/AWG-9/AIM-54A Weapon system as it relates to the Performance Verification Launch (PVL) program.

The PVL program was established under AIRTASK No. A501-5104/054F/3501-000005, to perform those launches that were left unaccomplished during the F-14A Board of Inspection and Survey (BIS), and the Navy Technical Evaluation (NTE) program, and to provide a data base for the continuing evaluation of the AIM-54A missile. Parameters for the launches were either derived from BIS and NTE or developed exclusively for PVL. Five Electronic Counter Measures (ECM) launches were assigned and designed under the PVL program. One of these launches PVL-16 was assigned as a Technical Professional Work Assignment.

At this time, the five ECM launch parameters were still in the design stage under the guidance and control of the design engineer. The design engineer was tasked to lend guidance in the design of ECM tests for Navy Flight Verification (NFV) and PVL programs. During the period of time research and investigation were being undertaken by the design engineer in the area of PHOENIX missile Counter

Counter Measure (CCM) capabilities, the task of familiarizing oneself with the PHOENIX missile became the initial Technical Professional (TP) work project.

In order to gain experience in reducing and evaluating raw telemetry missile data several fleet launches were assigned for reduction and evaluation. The four fleet launches assigned included one ECM shot and three launches with differing launch modes (i.e., Track While Scan (TWS), Air Combat Maneuvering (ACM) Active and Pulsed Doppler Single Targe Track (PDSTT)). Then, as it became necessary, research was done in the area of basic radar operation and guidance logic for the PHOENIX missile. The first area researched was that of basic radar operation. In order to understand guidance problems and ambiquities in missile launches it was necessary to learn about pulsed radar operation. The active radar system in the PHOENIX missile is comprised primarily of a single transmitter/receiver. This bit of knowledge then led to research in Pulse Repetition Frequency modulation (PRF) in order to answer the question of ranging ambiquities in pulsed radars (particularly as it applies to the AWG-9 radar). The operation of PRF modulation as explained in reference (2) and clarified by the technical director is as follows. Ordinarily, unmodulated pulsed radar could produce a false range track on a target (A) as shown below, and therefore A would appear to be closer than it actually was.



Unmodulated Pulse and Signal

Figure 1

Figure 1 shows image B to be less than the maximum unambiguous range (determined by the pulse rate of the radar) as each return from B occurs prior to the next pulse. But target A is ambiguous as its range is between one to two times the unambiguous range and appears to be closer after the second pulse. In order to alleviate this problem, the PRF modulation method was employed and operates as follows:

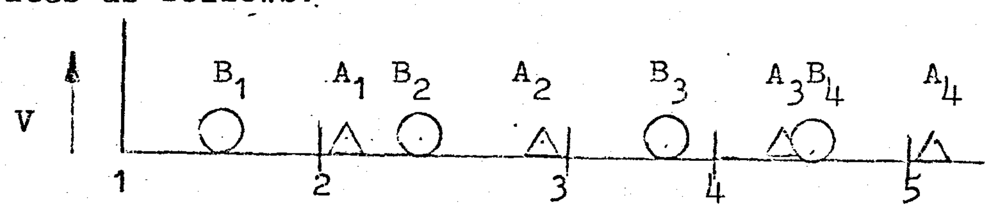


Figure 2 Modulated Pulse and Signals

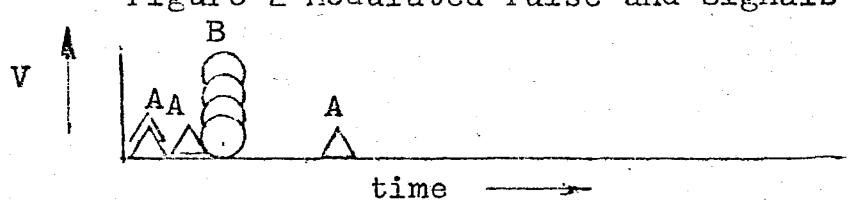


Figure 3 Summing Signals

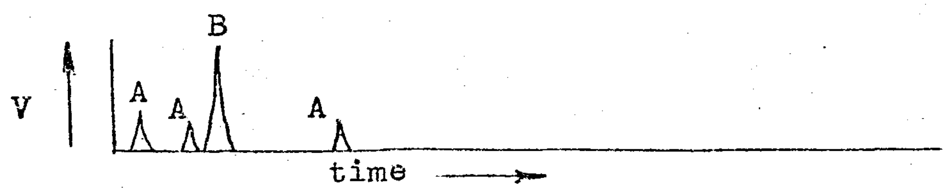


Figure 4 Sum of Signals

By modulating the frequency, as shown in figure 2, and triggering from the pulse (see figure 3) an image of target, B, which is less that the maximum unambiguous range, increases in amplitude (above the threshold voltage) and is detected. For targets whose range is greater than the maximum unambiguous range the return image would be blurred according to the number of different frequencies used.

An attempt was also made to aquaint oneself with the theory behind several other radar phenomenon, such as; sidelobes and isodops, range gateing and high and low PRF coherent pulsed doppler radar frequency spectrum (see reference 3). Once the introduction to radar was completed, the PHOENIX guidance system was investigated. Hughes Aircraft Company has furnished Systems Engineering Analysis (SEA) reports on most of the missile systems and subsystems, which subsequently serves as the main text at this time. The following section will include a summary of the F-14A/AWG-9/AIM-54A weapons systems as obtained through reading from the SEA reports.

F-14A/AWG-9/AIM-54A Weapon System

The Phoenix missile (AIM-54A) can operate in either

active or semi active modes. The missile and AWG-9 radar system also have the unique ability to communicate during missile flight via missile messages. These coded missile messages enable the AWG-9 to command the inflight, semi active missile to an active mode. The AWG-9 also has the capability of updating the missile and in so doing, may control several inflight missiles simultaneously. Basically, the missile may be launched in one of three AWG-9 launch modes; Single Target Track (STT), Track While Scan (TWS) or Air Combat Maneuvering (ACM) Active.

The AWG-9 can maintain track on several targets simultaneously and in so doing facilitates rapid reattack capabilities. When more than one target is maintained on a track file, the aircrew may launch AIM-54 missiles in the ACM active mode by first selecting a target then launching the missile. At Launch To Eject (LTE) the mislile is given guidance data and an Active Transfer Command (ATC). This then allows the missile to actively guide on the target, releasing the AWG-9 of the responsibility to maintain track on the target. Since the AWG-9 radar system has the ability to maintain track files on up to six targets, six AIM-54A missiles may be launched at six different targets in a matter of seconds.

In STT mode, the F-14A/AWG-9/AIM-54A weapon system maintains track on one target and may launch a Semi Active (SA) PHOENIX missile at the target illuminated. The AIM-54A when launched in this mode, receives regular

missile messages from the AWG-9 which provide tracking data updates and steering commands. The passive AIM-54A then guides Semi Actively to target intercept. In this mode, the target must remain illuminated during the entire missile flight time as the AIM-54A would not have the capability to guide actively.

When the AIM-54A is launched in TWS, preset instructions allow the missile to obtain an optimum aerodynamic flight geometry for each particular launch. During the first phase of missile flight, the AIM-54A guides via sample data (this missile mode is called Sample Data Active, SD/A.) The missile receives tracking data with each missile message, eventually receiving an ATC (in a missile message). At this time, the missile attempts to go active. If a successful active transfer occurs, the missile then guides actively to intercept. If for some unforeseen reason the missile should lose track during active flight, it may receive and process the next missile message sent for sample data. At LTE, each missile is assigned a code so that during missile flight, only those missile messages postscripted with the proper missile code will be processed. Because each missile message is coded, up to six missiles may be launched in TWS and simultaneously controlled by the AWG-9 during missile flight.

Reducing Missile Data

Once it was felt a basic understanding of the methods

of operation of the F-14A/AWG-9/AIM-54A weapon system was obtained, four fleet launches were assigned for evaluation. The distinguishing difference between fleet launches and launches conducted on the Pacific Missile Range by the Pacific Missile Test Center (formerly Naval Missile Center) is the amount and types of data obtained. The F-14'S used by the Systems Evaluation Directorate, formerly Test Operations Department, are specially instrumental aircraft. From these specially instrumental aircraft, AWG-9 data is obtained via analog tabulation (antab) data. The antab data will recover such AWS-9 data as AWG-9 launch mod, launch range, the number of missile messages sent, information sent with each missile message, etc. Fleet launches usually never provide antab data.

Radar data is usually available for launches performed on National Ranges. The four fleet launches assigned were performed at Barking Sands, Hawaii and therefore were provided radar coverage. Radar data is usually smoothed into two forms (G-2-3) and G-4-1) which differ in information provided and also in the reference frame used (i.e.; for one set of data all measurements are made relative to the intercepter, G-2-3, and the other set uses an arbitrary static reference point, G-4-1).

For both Pacific Missile Test Center and Fleet launches, missiles used in test launches usually have a telemetry package which telemeters up to 108 channels of

missile functions (for non warhead missiles). The analog data gathered from these telemetry packages is used to determine missile guidance performance. Prior to aircraft take-off, Missile On Aircraft Tests, MOATs, (MOATs are a portion of the AWG-9 Built-In Test system, BITS) are conducted and missile responses are monitored and evaluated real time to insure the equipment is functioning properly.

In order to evaluate the analog data obtained from each launch, calibration tables and charts are created from laboratory results for each of the 108 telemetry channels. Three strip charts were then devised for the three most often used banks of data (launch data generally provides 10 banks of data containing eight data channels per bank) in order to facilitate ease of reading missile data. The MOATS run during each flight prior to the "hot" run (the portion of the flight when LTE is initiated) are also used as calibration sources for a few of the telemetry channels where accuracy is especially important.

The targets used on the range are generally instrumented and telemeter real time target data. Of major importance is the miss distance obtained from this data either derived by photon scoring or cooperative doppler methods.

The final source of data usually available when evaluating a launch for a final launch report is the preliminary firing message prepared by the agency performing

(responsible for evaluating) the test. This is generally called a 24 hour launch report and is prepared by the lead engineer on the project. This report generally contains de-brief information about the launch as well as basic information otherwise almost impossible to obtain, such as target type, augmentation used, ECM used, fuze type, etc.

For the four fleet launches evaluated, antab data was not available and the preliminary firing message was found for only one launch. The type of information obtained and the format used can be seen in Appendix A.

The four launches were completely different comprising:

(1) 29 Sept. 1974, missile number 20015, was a co-altitude ACM Active Boresight launch at a BQM-34A target.

(2) 21 Aug. 1974, missile number 20055, was a look-up TWS launch at a BQM-34A target in an ECM environment.

(3) 23 July 1974, missile number F-626, was a look-down Pulse Doppler Single Target Track, (PDSTT) launch at an augmented BQM-34E target.

(4) 27 Sept. 1974, missile number 20053, was a head on, look-up TWS launch at a clear (unaugemented) BQM-34A target.

The ECM launch, particularly lent beneficial experience in an area that is covered by the test plan developed for the PVL program. Due to the sensitivity of the material, the results of the evaluations made of the fleet launches will not be discussed in this report.

PVL Test Plan

It seemed desirable to perform four specific ECM tests for two reasons: (1) The launches if used in the PVL program could also be applied to the OPEVAL (Operational Evaluation) program conducted by VX-4 (Air Test and Evaluation Squadron FOUR) and (2) the F-14A/AWG-9/AIM-54A weapon system capabilities in the proposed environments were previously ill defined. For each proposal, certain parameters were hard (not to be changed) as they crucially effected the nature of the threat and others were soft (varying from one test to another). Those parameters that were soft could be manipulated, possibly to test or verify other characteristics of the weapon system. The parameters that were initially selected were taken from captive flight parameters proposed in the Naval Flight Verification (NFV) Program Test Plan. The initial test of the suitability of these parameters came as a result of determining the (Launch Acceptability Region) LARs for each launch parameter. This test determines if the AWG-9 radar will allow the AIM-54A to be launched in each particular situation.

The next test of the feasibility of the launch parameters was the aerodynamic simulation for the AIM-54A missile. This simulation was run for each launch over all of the parameter bounds (i.e.; for high and low bounds of; range, aspect angle, look angle, etc.) to determine if the missile could theoretically get to the target. The aerodynamic range of the missile as calculated in these

simulations is also used as range criterion (if the maximum range of the missile exceeded the range safety requirements, the parameters would be rejected).

As a final test, the operational environment was simulated on the SITS (System Integrated Test Station) equipment. In this system, all the components of a weapon system plus its operating environment are simulated, thereby allowing all-around compatability of total system components to be tested.

Concurrently, research was being initiated to determine the PHOENIX missile Counter-Counter Measures (CCM) capability in each of these ECM environments. It was necessary in designing the test plan to be certain of the required train of events leading to a successful target track and intercept. Potential problem areas had to be clearly defined in the test plan so as to be easily recognized if and when they occurred in the actual launch.

Following the introduction of the fifth launch parameter and successful investigation of LARS, aerodynamic simulation, and SITS evaluation, the Test Plan was written for launches PVL-14, -15, -16, -17, -18 (see Appendix F) in accordance with the Test Plan Format found in Appendix G.

Due to funding problems, the Flight Test Program for PVL-14, -15, -16, -17, -18 has been temporarily suspended. To replace the follow-on effort unavailable in the PVL program, experience in evaluating flight test data and

writing the Final Flight Test Report for OPEVAL mission E-4 is hereby substituted.

OPEVAL Final Launch Report

On 27 March 1975 a PHOENIX AIM-54A missile was launched by Air Test and Evaluation Squadron FOUR to satisfy the objectives of PHOENIX Operational Evaluation test E-4. Missile on ground and in-flight BITS were conducted and monitored real time. Once these were completed and satisfied, up missiles were designated and a "hot" run commenced. During the "hot" run, AWG-9 mode was select as automatic TWS. The missile (missile number 20024) was launched in SD/A mode and guided successfully to intercept. After the aircrew landed, a de-brief was attended by aircrew and engineers. In flight launch condition information was exchanged and it was noted that the AWG-9 mode was switched during missile flight.

VX-4 wrote the preliminary firing report for the launch which was received 30 March 1975. The significance of the mode switch was noted in the preliminary analog missile data and confirmed in the smoothed data. Smoothed G-2-3, and G-4-1 radar data was used to determine the exact launch parameters. The only problem area encountered in evaluating the data was during the period of missile flight when telemetry dropped out, which failed to reveal two relatively insignificant data points. Evaluation was completed, and the Final Launch Report

written (see cover letter, Appendix F). The Final Report was submitted for review at a division meeting on 29 May 1975 and has just completed the rewrite stage.

The Final Launch Report Format shown in Appendix H was used in developing the Final Report for OPEVAL mission E-4.

Results

A rather disjointed, but none-the-less complete, flight test cycle comprised of Flight Test Plan (PVL-14, -15, -16, -17, -18), technical and operational brief (Naval Flight Verification Program), flight test, debrief and Final Launch Report (OPEVAL mission E-4) was experienced. Evaluation of several fleet launches supplemented the required quota as well as researching a wide variety of PHOENIX missile capabilities.

CONCLUSION

The programs developed for storage and retrieval of AIM-54A test data were designed to be used by engineers in the PHOENIX missile section. The adequacy of the programs was determined by use, and the results were judged acceptable by the Technical Director. Launch data has since been stored and the storing of new data implemented as standard procedure.

The introduction to PHOENIX launch data by working with the programs proved to be valuable as an overview of missile capabilities and because of the variety of launch types evaluated, a firm foundation was established in the area of PHOENIX flight testing.

The flight test cycle experienced during the PVL and OPEVAL programs provided a realistic look at missile flight testing as concurrent missile tests are found to be more common than not. The exposure to Navy and Contractor interfacing, budgeting and planning problems experienced in this assignment provided an honest look at the realistic world of missile testing.

REFERENCES

(1) "Hewlett-Packard 9830A Calculator", Copyright by Hewlett-Packard Company, 1973.

(2) "PHOENIX Weapon Control System", HAC Ref. C5278, 15 May 1972.

(3) "Radar Handbook" by Skolnik, Copyright 1970 by McGraw-Hill, Inc.

APPENDIX A

DATA FORMAT AND OCTAL CODES

PROGRAM DATA

MISSION ___ ___ ___ ___ ___ ___ ___ ___
TITLE ___ ___ ___ ___ ___ ___ ___ ___ ___ ___
FTR ___ ___ ___ ___ ___ ___ ___ ___
MSILE # ___ ___ ___ ___ ___ ___

LAUNCH PARAMETERS

L ALT (KFT) ___ ___ ___ ___ ___
L MACH # ___ ___ ___ ___
L VEL (KTS) ___ ___ ___ ___
L HDG (DEG) ___ ___ ___ ___ ___
L RNGE (NM) ___ ___ ___ ___ ___
R RATE (KHZ) ___ ___ ___ ___ ___
R RATE (KTS) ___ ___ ___ ___ ___

TARGET PARAMETERS

T ALT (KFT) ___ ___ ___ ___ ___
T MACH # ___ ___ ___ ___
T VEL (KTS) ___ ___ ___ ___
T HDG (DEG) ___ ___ ___ ___ ___
T TYPE ___ ___ ___ ___ ___ ___ ___ ___ ___ ___
AUG/ECM ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

RELATIVE DATA

TCA (DEG) ___ ___ ___ ___ ___
ASPECT (DEG) ___ ___ ___ ___ ___
LOOK ANG (DEG) ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

MISSILE DATA

L MODE ___ ___ ___ ___ ___ ___ ___ / ___ ___ ___ ___ ___ ___ ___ ___ ___
LDYN PRESS (PSF) ___ ___ ___ ___
MISS FLT TIME (SEC) ___ ___ ___ ___ ___
G BIAS (G) ___ ___ ___ ___ ___ ___
H BIAS ___ ___
GO ___
ATC TIME (SEC) ___ ___ ___ ___ ___
MISS DIST (FT) ___ ___ ___ ___
ACT FREQ ___ ___ ___ ___
STA NO ___
FTS ACTIV ___ ___ ___ ___ ___
RMBT (SEC) ___ ___ ___ ___

FUZE FUNCTIONS

ITL RETURN (SEC) ___ ___ ___ ___ ___
ATI (ENERG) (SEC) ___ ___ ___ ___ ___
ARM PULSE (SEC) ___ ___ ___ ___ ___
C PULSE (SEC) ___ ___ ___ ___ ___ ___ ___ ___ ___
F PULSE (SEC) ___ ___ ___ ___ ___ ___ ___ ___ ___
TYPE FUZE ___ ___ ___ ___ ___ ___ ___ ___ / ___ ___ ___ ___ ___ ___ ___

COMMENTS

OBJECTIVE ACHD ___ ___ ___
COMMENTS ___ ___ ___ ___ ___ ___ ___ ___ / ___ ___ ___ ___ ___ ___ ___

OCTAL CODE	ASCII CHARACTER	OCTAL CODE	ASCII CHARACTER	OCTAL CODE	ASCII CHARACTER
040	△ (blank)	076	>	134	\
041	!	077	?	135	]
042	"	100	@	136	↑
043	#	101	A	137	←
044	$	102	B	141	a
045	%	103	C	142	b
046	&	104	D	143	c
047	' (apost.)	105	E	144	d
050	(	106	F	145	e
051	)	107	G	146	f
052	*	110	H	147	g
053	+	111	I	150	h
054	, (comma)	112	J	151	i
055	-	113	K	152	j
056	.	114	L	153	k
057	/	115	M	154	l
060	0	116	N	155	m
061	1	117	O	156	n
062	2	120	P	157	o
063	3	121	Q	160	p
064	4	122	R	161	q
065	5	123	S	162	r
066	6	124	T	163	s
067	7	125	U	164	t
070	8	126	V	165	u
071	9	127	W	166	v
072	:	130	X	167	w
073	;	131	Y	170	x
074	<	132	Z	171	y
075	=	133	[	172	z

APPENDIX B

OPERATING INSTRUCTIONS

THIS IS THE DATA STORAGE PROGRAM

TO RUN THIS PROGRAM, ALL THAT IS NECESSARY IS:

(1) FIRST TO NOTE THE NUMBER ON THE BACKSIDE (SIDE B) OF THE CASSETTE GIVEN TO BE THE LAST DATA FILE ENTERED.
(2) THEN OPEN THE CASSETTE DOOR ON THE 9830A AND SLIP IN THE CASSETTE SO THAT SIDE A IS FACING YOU, THEN CLOSE THE DOOR.
(3) PRESS (LOAD),(0),(EXECUTE)
(4) AFTER THE DATA STORAGE FILE HAS BEEN STORED A LAZY (T) WILL APPEAR IN THE LEFT SIDE OF THE DISPLAY. IT WILL THEN BE POSSIBLE TO RUN THE PROGRAM BY PRESSING (RUN),(EXECUTE).
(5) A QUESTION WILL THEN APPEAR FOLLOWED BY THE NUMBER OF CHARACTERS THAT WILL BE ALLOWED FOR THAT PARTICULAR QUESTION. YOU MAY ENTER YOUR DATA CORRESPONDING TO THAT QUESTION AT THIS TIME, SO LONG AS THE NUMBER OF CHARACTERS IN YOUR REPLY DOES NOT EXCEED THE NUMBER ALLOTED FOR THIS QUESTION. THE METHOD USED FOR ANSWERING THESE QUESTIONS IS AS FOLLOWS; PRESS (THE KEYS CORRESPONDING TO YOUR ANSWER),(EXECUTE).
(6) YOU THEN REPEAT THE PROCEDURE OUTINED IN (5) TO ANSWER THE REMAINDER OF THE QUESTIONS. IT WILL THEN AUTOMATICALLY RECYCLE ITSELF UNTIL THE USER INDICATES THAT HE OR SHE DOES NOT WISH TO ENTER ANOTHER STRING OF DATA BY ANSWERING (NO),(EXECUTE) TO THE QUESTION (WANT TO STORE ANOTHER STRING?)

THIS IS THE DATA RECOVERY PROGRAM

TO RUN THIS PROGRAM, ALL THAT IS REQUIRED IS:

(1) TO OPEN THE CASSETTE DOOR ON THE 9830A, PLACE THE CASSETTE IN THE CASSETTE COMPARTMENT WITH SIDE A FACING THE USER, THEN CLOSE THE DOOR.
(2) THEN PRESS (LOAD),(1),(EXECUTE) AND WAIT UNTIL THE PROGRAM HAS BEEN COMPLETELY LOADED (INDICATED BY THE PRESENCE OF A LAZY (T) IN THE LEFT CORNER OF THE DISPLAY) BEFORE PROCEEDING ON TO THE NEXT STEP.
(3) NOW PRESS (RUN),(EXECUTE).
(4) NOW ANSWER ALL OF THE QUESTIONS ASKED OF YOU BY PRESSING (THE KEYS CORRESPONDING TO YOUR ANSWER),(EXECUTE). IF SPECIFIC LAUNCHES ARE DESIRED, SEE BELOW FOR INSTRUCTIONS FOR ENTERING CONSTRAINTS.

ENTERING THE CONSTRAINTS.........

(5) PRESS (FETCH),(KEYS CORRESPONDING TO THE LINE NUMBER GIVEN THAT WILL HOLD YOUR CONSTRAINTS....IT WILL BE PRINTED OUT IN A COMMAND STATEMENT.....THERE WILL BE ONE LINE NUMBER GIVEN FOR EACH CONSTRAINT ENTERED),(EXECUTE).
(6) PRESS (BACK) REPEATEDLY UNTIL THE FLASHING BLOCK COVERS THE FIRST CHARACTER IN THAT LINE (NOT THE LINE NUMBER!!) THEN START ENTERING YOUR CONSTRAINT STATEMENT.....WHEN THAT IS COMPLETED PRESS (END OF LINE).
(7) IF WHILE ENTERING THE CONSTRAINT YOU RUN INTO THE (THEN) STATEMENT, SIMPLY TAP THE (INSERT) KEY ONCE FOR EACH REMAINING CHARACTER (IF THE FLASHING BOX IS STILL ON THE DISPLAY).
(8) REPEAT FOR THE REMAINDER OF YOUR CONSTRAINTS.

DEFINING THE CONSTRAINT STATEMENT.....

(9) REFER TO YOUR XEROX EXPLANATION AND FORMAT.

BELOW WILL BE SHOWN THE FORMAT TO BE USED IN SPECIFYING WHICH BIT OF DATA THAT WILL BE IMPLEMENTED IN THE CONSTAINT(S). THE METHOD OF EMPLOYING THESE CONSTRAINT(S) WILL THEN FOLLOW.

DATA TO BE INSPECTED	IDENTIFIED BY:
MISSION (DATE)	Z$(1,8)
MISSION (TITLE)	Z$(1,18)
FIGHTER AIRCRAFT TYPE AND NUMBER	Z$(19,26)
MISSILE NUMBER	Z$(27,32)
LAUNCH ALTITUDE (KFT)	Z$(33,37)
LAUNCH MACH NUMBER	Z$(38,41)
LAUNCH VELOCITY (KNOTS)	Z$(42,45)
LAUNCH HEADING (IN DEGREES)	Z$(46,50)
LAUNCH RANGE (NAUTICAL MILES)	Z$(51,55)
RANGE RATE (KHZ)	Z$(56,60)
RANGE RATE (KNOTS)	Z$(61,65)

TARGET ALTITUDE (KFT)	Z$(66,70)
TARGET MACH NUMBER	Z$(71,74)
TARGET VELOCITY (KNOTS)	Z$(75,78)
TARGET HEADING (IN DEGREES)	Z$(79,83)
TARGET TYPE	Z$(84,93)
AUGMENTATION AND/OR ECM	Z$(94,105)
TRACK CROSSING ANGLE (IN DEGREES)	Z$(106,110)
ASPECT ANGLE (IN DEGREES)	Z$(111,115)
LOOK ANGLE (IN DEGREES)	Z$(116,126)
LAUNCH MODE (FIRST PART)	Z$(127,135)
LAUNCH MODE (SECOND PART)	Z$(136,144)
LAUNCH DYNAMIC PRESSURE (PSF)	Z$(145,148)
MISSILE FLIGHT TIME (SEC)	Z$(149,153)
G BIAS (G'S)	Z$(154,159)
H BIAS (G'S)	Z$(160,161)
G0	Z$(162,165)
ACTIVE TRANSFER TIME (SEC)	Z$(166,170)
MISS DISTANCE (FEET)	Z$(171,174)
ACTIVE FREQUENCY	Z$(175,178)
STATION NUMBER	Z$(179,179)
FTS ACTIVATE	Z$(180,184)
ROCKET MOTOR BURN TIME (SEC)	Z$(185,188)
ITL RETURN (SEC)	Z$(189,193)
ATI (ENERGIZE) (SEC)	Z$(194,198)
ARM PULSE (SEC)	Z$(199,203)
COUNTER PULSE (SEC)	Z$(204,212)
FIRE PULSE (SEC)	Z$(213,221)
TYPE OF FUSE (TYPE)	Z$(222,229)
TYPE OF FUZE (SERIAL NUMBER)	Z$(230,237)
OBJECTIVES ACHIEVED (COMMENTS)	Z$(238,240)
BASIC COMMENTS (1ST PART)	Z$(241,248)
BASIC COMMENTS (2ND PART)	Z$(249,255)

THE METHOD TO BE IMPLOYED IN EXPLAINING HOW TO TRANSFORM VERBAL CONSTRAINTS INTO THE NEEDED MATHEMATICAL ONE(S) IS BY THE USE OF EXAMPLES.....FOR INSTANCE, IF DATA IS REQUIRED FOR THOSE TESTS CONDUCTED SUCH THAT THE LAUNCH WAS MADE ABOVE 24000 FEET WITH A ROCKET MOTOR BURN TIME OF 23.0 SECONDS OR LONGER, TWO CONSTRAINTS WOULD THEN BE ENTERED INTO THE PROGRAM AS SHOWN BELOW.

ENTERING THE ALTITUDE CONSTRAINT FIRST WOULD YIELD:

Z$(33,37)> (QUOTE) 24.00 (UNQUOTE) ....WHICH COMPARES OCTAL

VALUES OF STRINGS ON BOTH SIDES OF THE INEQUALITY.

VAL(Z$(33,37))> 24 ....WHICH COMPARES NUMERICAL VALUES

THE SECOND CONSTRAINT WOULD THEN BE:

VAL(Z$(185,188))>= 23 ... THIS FORMAT MUST BE USED WHEN THERE IS A CHANCE OF A NON-NUMERIC ANSWER. AS IT WOULD NOT RECOGNIZE THE NON-NUMERIC ANSWERS. IF ON THE OTHER HAND, IT IS DESIRABLE TO SEARCH FOR A NON-NUMERIC ANSWER, SIMPLY USE.......

THE Z$(WHATEVER)>= (QUOTE) DESIRED ANSWER (UNQUOTE) FORMAT.

THEREFORE THE END CONSTRAINTS WOULD LOOK LIKE:

```
450 IF VAL(Z$(33,37))>24 THEN 580

470 IF VAL(Z$(185,188))=23 THEN 580
```

THE (IF) IS ALREADY PROVIDED, ALL THAT IS REQUIRED IS FOR THE LINE TO BE EDITED AS SHOWN ABOVE.

TO EDIT THE CORRESPONDING IF STATEMENT CALL THAT LINE (DETAILED IN THE PREVIOUS INSTRUCTIONS) AND THEN TAP THE (BACK) KEY UNTIL THE FLASHING BOX IS ONE CHARACTER BEHIND THE (IF) IN THE IF STATEMENT. THIS THEN ALLOWS THE USER TO TYPE IN THE CONSTRAINT.....WARNING... ..IF THE USER GETS TO THE (THEN 580) PART OF THE STATEMENT BEFORE HE OR SHE HAS COMPLETELY ENTERED HIS OR HER CONSTRAINT, SIMPLY TAP THE (INSERT) KEY UNTIL AMPLE ROOM EXISTS ON THE LINE.

GREATER THAN = (>)
LESS THAN = (<)
EQUAL TO = (=)
LESS THAN OR EQUAL TO = (<=)
GREATER THAN OR EQUAL TO = (>=)
NOT EQUAL TO = (#)

APPENDIX C

DATA STORAGE PROGRAM

```
10 COM K$[255],B$[255],C$[255],D$[255],E$[255],F$[255],G$[255],H$[255]
20 DIM Z$[255],A$[100]
25 W=0
30 A$="                                  "
40 DISP "INPUT THE LAST DATA FILE NO.";
50 INPUT Q3
60 LOAD  DATA Q3
63 REM
65 REM HOW THE LAST DATA STRING ENTERED WILL BE DETERMINED
67 REM
70 IF H$=H$[256,255] THEN 90
80 GOTO 330
90 IF G$=G$[256,255] THEN 120
100 I=7
110 GOTO 310
120 IF F$=G$[256,255] THEN 150
130 I=6
140 GOTO 310
150 IF E$=G$[256,255] THEN 180
160 I=5
170 GOTO 310
180 IF D$=G$[256,255] THEN 210
190 I=4
200 GOTO 310
210 IF C$=G$[256,255] THEN 240
220 I=3
230 GOTO 310
240 IF B$=G$[256,255] THEN 270
250 I=2
260 GOTO 310
270 IF K$=G$[256,255] THEN 300
280 I=1
290 GOTO 310
300 I=0
310 Q3=Q3-1
320 GOTO 340
323 REM
325 REM IF THE ENTIRE DATA FILE IS FULL, THE NEW DATA WILL GO INTO THE NEXT
326 REM DATA FILE.....Q3+1
327 REM
330 I=0
340 I1=0
344 REM
345 REM THE DATA STRINGS ARE ENTERED BY ANSWERING THE FOLLOWING QUESTIONS....
346 REM
350 DISP "INPUT MISSION (DATE) 8 CHAR";
360 INPUT Z$
370 Z$[LEN(Z$)+1]=A$[1,13]
380 DISP "MISSION (TITLE) 10 CHAR";
390 INPUT Z$[9]
400 Z$[LEN(Z$)+1]=A$[1,13]
401 DISP "FIGHTER TYPE (8 CHAR)";
402 INPUT Z$[19]
403 Z$[LEN(Z$)+1]=A$[1,13]
410 DISP "MISSILE NUMBER (6 CHAR)";
420 INPUT Z$[27]
430 Z$[LEN(Z$)+1]=A$[1,13]
440 DISP "LAUNCH ALTITUDE,KFT(5 CHAR)";
450 INPUT Z$[33]
```

```
460 Z$[LEN(Z$)+1]=A$[1,13]
470 DISP "LAUNCH MACH (4 CHAR)";
480 INPUT Z$[38]
490 Z$[LEN(Z$)+1]=A$[1,13]
500 DISP "LAUNCH VELOCITY,KTS(4 CHAR)";
510 INPUT Z$[42]
520 Z$[LEN(Z$)+1]=A$[1,13]
530 DISP "LAUNCH HEADING,DEG(5 CHAR)";
540 INPUT Z$[46]
550 Z$[LEN(Z$)+1]=A$[1,13]
560 DISP "LAUNCH RANGE,NM(5 CHAR)";
570 INPUT Z$[51]
580 Z$[LEN(Z$)+1]=A$[1,13]
590 DISP "RANGE RATE IN KHZ(5 CHAR)";
600 INPUT Z$[56]
610 Z$[LEN(Z$)+1]=A$[1,13]
611 DISP "RANGE RATE IN KTS(5 CHAR)";
612 INPUT Z$[61]
613 Z$[LEN(Z$)+1]=A$[1,13]
620 DISP "TARGET ALTITUDE IN KFT(5 CHAR)";
630 INPUT Z$[66]
640 Z$[LEN(Z$)+1]=A$[1,13]
650 DISP "TARGET MACH NO.(4 CHAR)";
660 INPUT Z$[71]
670 Z$[LEN(Z$)+1]=A$[1,13]
680 DISP "TARGET VELOCITY KTS(4 CHAR)";
690 INPUT Z$[75]
700 Z$[LEN(Z$)+1]=A$[1,13]
710 DISP "TARGET HEADING DEG(5 CHAR)";
720 INPUT Z$[79]
730 Z$[LEN(Z$)+1]=A$[1,13]
740 DISP "TARGET TYPE(10 CHAR)";
750 INPUT Z$[84]
760 Z$[LEN(Z$)+1]=A$[1,13]
770 DISP "AUG/ECM(12 CHAR)";
780 INPUT Z$[94]
790 Z$[LEN(Z$)+1]=A$[1,13]
800 DISP "TCA IN DEG(5 CHAR)";
810 INPUT Z$[106]
820 Z$[LEN(Z$)+1]=A$[1,13]
830 DISP "ASPECT IN DEG(5 CHAR)";
840 INPUT Z$[111]
850 Z$[LEN(Z$)+1]=A$[1,13]
860 DISP "LOOK ANGLE,DEG(11 CHAR)";
870 INPUT Z$[116]
880 Z$[LEN(Z$)+1]=A$[1,13]
890 DISP "LAUNCH MODE(1ST PART)(9 CHAR)";
900 INPUT Z$[127]
910 Z$[LEN(Z$)+1]=A$[1,13]
920 DISP "LAUNCH MODE(2ND PART)(9 CHAR)";
930 INPUT Z$[136]
940 Z$[LEN(Z$)+1]=A$[1,13]
950 DISP "LAUNCH DYN PRESS IN PSF(4 CHAR)";
960 INPUT Z$[145]
970 Z$[LEN(Z$)+1]=A$[1,13]
980 DISP "MISS. FLT. TIME SEC(5 CHAR)";
990 INPUT Z$[149]
1000 Z$[LEN(Z$)+1]=A$[1,13]
1010 DISP "G-BIAS(G)(6 CHAR)";
1020 INPUT Z$[154]
1030 Z$[LEN(Z$)+1]=A$[1,13]
```

```
1040 DISP "H-BIAS(G)(2 CHAR)";
1050 INPUT Z$[160]
1060 Z$[LEN(Z$)+1]=A$[1,13]
1070 DISP "G0(4 CHAR)";
1080 INPUT Z$[162]
1090 Z$[LEN(Z$)+1]=A$[1,13]
1100 DISP "ATC TIME, SEC(5 CHAR)";
1110 INPUT Z$[166]
1120 Z$[LEN(Z$)+1]=A$[1,13]
1130 DISP "MISS DIST., FT(4 CHAR)";
1140 INPUT Z$[171]
1150 Z$[LEN(Z$)+1]=A$[1,13]
1160 DISP "ACTIVE FREQUENCY(4 CHAR)";
1170 INPUT Z$[175]
1180 Z$[LEN(Z$)+1]=A$[1,13]
1190 DISP "STATION NO.(1 CHAR)";
1200 INPUT Z$[179]
1210 Z$[LEN(Z$)+1]=A$[1,13]
1220 DISP "FTS ACTIV (5 CHAR)";
1230 INPUT Z$[180]
1240 Z$[LEN(Z$)+1]=A$[1,13]
1280 DISP "ROCKET MOTOR BURN TIME(4 CHAR)";
1290 INPUT Z$[185]
1300 Z$[LEN(Z$)+1]=A$[1,13]
1340 DISP "ITL RETURN,SEC.(5 CHAR)";
1350 INPUT Z$[189]
1360 Z$[LEN(Z$)+1]=A$[1,13]
1370 DISP "ATI (ENERGIZE),SEC.(5 CHAR)";
1380 INPUT Z$[194]
1390 Z$[LEN(Z$)+1]=A$[1,13]
1400 DISP "ARMING PULSE(SEC)(5 CHAR)";
1410 INPUT Z$[199]
1420 Z$[LEN(Z$)+1]=A$[1,13]
1430 DISP "COUNTER PULSE,SEC.(9 CHAR)";
1440 INPUT Z$[204]
1450 Z$[LEN(Z$)+1]=A$[1,13]
1451 DISP "FIRE PULSE (SEC)(9 CHAR)";
1452 INPUT Z$[213]
1453 Z$[LEN(Z$)+1]=A$[1,13]
1460 DISP "FUSE TYPE(1ST OF 8)";
1470 INPUT Z$[222]
1480 Z$[LEN(Z$)+1]=A$[1,11]
1490 DISP "FUSE TYPE(2ND OF 8)";
1500 INPUT Z$[230]
1503 Z$[LEN(Z$)+1]=A$[1,13]
1511 DISP "OBJECTIVE ACHIEVED (3 CHAR)";
1512 INPUT Z$[238]
1513 Z$[LEN(Z$)+1]=A$[1,13]
1514 DISP "COMMENTS?? (UP TO 15 CHAR)";
1515 INPUT Z$[241]
1519 I=I+1
1520 GOTO I OF 1530,1550,1570,1590,1610,1630,1650,1670
1522 REM
1525 REM THE DATA STRING JUST ENTERED INTO Z$ WILL NOW BE ENTERED INTO ITS RE-
1526 REM SPECTIVE DATA STRING..........
1527 REM
1530 K$=Z$
1540 GOTO 1680
1550 B$=Z$
1560 GOTO 1680
```

```
1570 C$=Z$
1580 GOTO 1680
1590 D$=Z$
1600 GOTO 1680
1610 E$=Z$
1620 GOTO 1680
1630 F$=Z$
1640 GOTO 1680
1650 G$=Z$
1660 GOTO 1680
1670 H$=Z$
1680 IF I=8 THEN 1720
1690 DISP "WANT TO STORE ANOTHER STRING";
1700 INPUT Z$
1710 IF Z$#"NO" THEN 340
1715 W=1
1720 I1=I1+1
1722 REM
1723 REM THE REMAINING DATA STRINGS ARE SET EQUAL TO THE EMPTY STRING $(256,255)
1725 REM
1726 REM FOLLOWING THE LAST DATA FILE ENTERED IS A DUMMY FILE CONTAINING H$=
1727 REM THE SUBSTRING "ZIP  " SO AS TO INDICATE THAT NO MORE DATA FILES EXIST
1729 REM
1730 GOTO I+1 OF 1735,1740,1750,1760,1780,1790,1800,1810
1733 GOTO 1820
1735 K$=B$[256,255]
1740 B$=B$[256,255]
1750 C$=B$[256,255]
1760 D$=B$[256,255]
1780 E$=B$[256,255]
1790 F$=B$[256,255]
1800 G$=B$[256,255]
1810 H$=B$[256,255]
1811 IF I1=1 THEN 1820
1812 H$="ZIP  "
1820 Q3=Q3+1
1830 STORE  DATA Q3
1840 I=0
1850 IF I1=1 THEN 1720
1860 IF W=1 THEN 1870
1865 DISP "WANT TO STORE ANOTHER STRING";
1866 INPUT Z$
1867 IF Z$#"NO" THEN 340
1870 PRINT
1880 PRINT "PLEASE PRINT LAST DATA FILE NO.,";Q3-1;"ON THE BACK OF DATA CASSETTE
1890 PRINT "THANK YOU!!"
1900 PRINT
1910 PRINT
1920 PRINT
1930 PRINT
1940 END
```

APPENDIX D

DATA RECOVERY PROGRAM

```
10 COM A$[255],B$[255],C$[255],D$[255],E$[255],F$[255],G$[255],H$[255],A1[180]
20 DIM N$[255],Z$[255],W$[255],X$[255],Y$[255],S[1,0],N[45],V[50]
30 Z=0
40 E1=1
42 REM
43 REM THE FIRST FOUR BITS OF DATA ARE ESTABLISHED BY INITIALIZING THESE
44 REM PARTS OF THE AI(180) ONE DIMENSIONAL MATRIX.....
45 REM
50 A[1]=1
60 A[46]=8
70 A[91]=1
80 A[136]=7
90 A[2]=9
100 A[47]=18
110 A[92]=8
111 A[137]=12
120 A[3]=19
130 A[48]=26
140 A[93]=13
150 A[138]=15
160 N[1]=45
170 N[2]=50
175 N[4]=50
180 N[3]=50
181 A[4]=27
182 A[49]=32
183 A[94]=16
184 A[139]=20
190 I=5
200 DISP "DO YOU WANT ALL OF THE DATA";
210 INPUT A$
220 IF A$="NO" THEN 250
221 REM
222 REM E1=2 IS USED IN (IF) STATEMENTS TO BY PASS QUESTIONS GIVEN THAT ALL THE
223 REM DATA IS REQUIRED........
224 REM
230 E1=2
240 GOTO 280
242 REM
243 REM THESE QUESTIONS CONTROL INITIALIZATION OF A(180) FOR THEIR RESPECTIVE
244 REM GROUPS OF DATA .....
245 REM
250 DISP "DO YOU WANT MISSILE DATA";
260 INPUT A$
270 IF A$="NO" THEN 710
280 A[I]=33
290 A[I+45]=37
300 A[I+90]=21
310 A[I+135]=25
320 N[I]=1
330 I=I+1
340 A[I]=38
350 A[I+45]=41
360 A[I+90]=26
370 A[I+135]=31
380 N[I]=54
390 I=I+1
400 A[I]=42
410 A[I+45]=45
```

```
420 A[I+90]=32
430 A[I+135]=36
440 N[I]=16
450 I=I+1
460 A[I]=46
470 A[I+45]=50
480 A[I+90]=37
490 A[I+135]=41
500 N[I]=11
510 I=I+1
520 A[I]=51
530 A[I+45]=55
540 A[I+90]=42
550 A[I+135]=47
560 N[I]=6
570 I=I+1
580 A[I]=56
590 A[I+45]=60
600 A[I+90]=48
610 A[I+135]=53
620 N[I]=21
630 I=I+1
640 A[I]=61
650 A[I+45]=65
660 A[I+90]=48
670 A[I+135]=53
680 N[I]=16
690 I=I+1
700 IF E1=2 THEN 740
710 DISP "DO YOU WANT TARGET DATA AT LTE";
720 INPUT A$
730 IF A$="NO" THEN 1110
740 A[I]=66
750 A[I+45]=70
760 A[I+90]=54
770 A[I+135]=58
780 N[I]=1
790 I=I+1
800 A[I]=71
810 A[I+45]=74
820 A[I+90]=59
830 A[I+135]=64
840 N[I]=54
850 I=I+1
860 A[I]=75
870 A[I+45]=78
880 A[I+90]=65
890 A[I+135]=69
900 N[I]=16
910 I=I+1
920 A[I]=79
930 A[I+45]=83
940 A[I+90]=70
950 A[I+135]=74
960 N[I]=11
970 I=I+1
980 A[I]=84
990 A[I+45]=93
1000 A[I+90]=75
1010 A[I+135]=80
1020 N[I]=50
```

```
1030 I=I+1
1040 A[I]=94
1050 A[I+45]=105
1060 A[I+90]=81
1070 A[I+135]=87
1080 N[I]=50
1090 I=I+1
1100 IF E1=2 THEN 1140
1110 DISP "DO YOU WANT RELATIVE DATA AT LTE";
1120 INPUT A$
1130 IF A$="NO" THEN 1330
1140 A[I]=106
1150 A[I+45]=110
1160 A[I+90]=88
1170 A[I+135]=90
1180 N[I]=11
1190 I=I+1
1200 A[I]=111
1210 A[I+45]=115
1220 A[I+90]=91
1230 A[I+135]=93
1240 N[I]=11
1250 I=I+1
1260 A[I]=116
1270 A[I+45]=126
1280 A[I+90]=94
1290 A[I+135]=101
1300 N[I]=11
1310 I=I+1
1320 IF E1=2 THEN 1360
1330 DISP "DO YOU WANT MISSILE PARAMETERS";
1340 INPUT A$
1350 IF A$="NO" THEN 1760
1360 A[I]=127
1370 A[I+45]=135
1380 A[I+90]=102
1390 A[I+135]=107
1400 N[I]=50
1410 I=I+1
1420 A[I]=136
1430 A[I+45]=144
1440 A[I+90]=19
1450 A[I+135]=19
1460 N[I]=50
1470 I=I+1
1480 A[I]=145
1490 A[I+45]=148
1500 A[I+90]=108
1510 A[I+135]=117
1520 N[I]=31
1530 I=I+1
1540 A[I]=149
1550 A[I+45]=153
1560 A[I+90]=118
1570 A[I+135]=129
1580 N[I]=36
1590 I=I+1
1600 A[I]=154
1610 A[I+45]=159
1620 A[I+90]=130
```

```
1630 A[I+135]=135
1640 N[I]=41
1650 I=I+1
1660 A[I]=160
1670 A[I+45]=161
1680 A[I+90]=136
1690 A[I+135]=141
1700 N[I]=41
1710 I=I+1
1720 A[I]=162
1730 A[I+45]=165
1740 A[I+90]=142
1750 GOTO 1770
1760 Z=1
1770 LINK 2
```

```
1440 IF E1=2 THEN 1460
1442 REM
1443 REM Z=1 WAS USED TO PREVENT INITIALIZATION OF A(180) FOR THIS PORTION
1444 REM OF THIS PARTICULAR GROUP OF DATA.  IT IS ONLY USED IF IT WAS INDICATED
1445 REM THAT THIS GROUP OF DATA WAS NOT DESIRED PREVIOUSLY.......
1448 REM
1450 IF Z=1 THEN 1860
1460 A[I+135]=143
1470 N[I]=50
1480 I=I+1
1490 A[I]=166
1500 A[I+45]=170
1510 A[I+90]=144
1520 A[I+135]=151
1530 N[I]=36
1540 I=I+1
1550 A[I]=171
1560 A[I+45]=174
1570 A[I+90]=152
1580 A[I+135]=160
1590 N[I]=26
1600 I=I+1
1610 A[I]=175
1620 A[I+45]=178
1630 A[I+90]=161
1640 A[I+135]=168
1650 N[I]=50
1660 I=I+1
1670 A[I]=179
1680 A[I+45]=179
1690 A[I+90]=169
1700 A[I+135]=174
1710 N[I]=50
1720 I=I+1
1730 A[I]=180
1740 A[I+45]=184
1750 A[I+90]=175
1760 A[I+135]=183
1770 N[I]=50
1780 I=I+1
1790 A[I]=185
1800 A[I+45]=188
1810 A[I+90]=184
1820 A[I+135]=187
1830 N[I]=36
1840 I=I+1
1850 IF E1=2 THEN 1890
1860 DISP "DO YOU WANT ANY OF THE FUSE FUNC";
1870 INPUT A$
1880 IF A$="NO" THEN 2310
1890 A[I]=189
1900 A[I+45]=193
1910 A[I+90]=188
1920 A[I+135]=197
1930 N[I]=36
1940 I=I+1
1950 A[I]=194
1960 A[I+45]=198
1970 A[I+90]=198
1980 A[I+135]=200
```

```
1990 N[I]=36
2000 I=I+1
2010 A[I]=199
2020 A[I+45]=203
2030 A[I+90]=201
2040 A[I+135]=209
2050 N[I]=36
2060 I=I+1
2070 A[I]=204
2080 A[I+45]=212
2090 A[I+90]=210
2100 A[I+135]=216
2110 N[I]=36
2120 I=I+1
2130 A[I]=213
2140 A[I+45]=221
2150 A[I+90]=217
2160 A[I+135]=223
2170 N[I]=36
2180 I=I+1
2190 A[I]=222
2200 A[I+45]=229
2210 A[I+90]=224
2220 A[I+135]=232
2230 N[I]=50
2240 I=I+1
2250 A[I]=230
2260 A[I+45]=237
2270 A[I+90]=A[I+135]=19
2280 N[I]=50
2290 I=I+1
2300 IF E1=2 THEN 2340
2310 DISP "DO YOU WANT CONCLUSION/COMMENTS";
2320 INPUT A$
2330 IF A$="NO" THEN 2490
2340 A[I]=238
2350 A[I+45]=240
2360 A[I+90]=233
2370 A[I+135]=244
2380 N[I]=50
2390 I=I+1
2400 A[I]=241
2410 A[I+45]=248
2420 A[I+90]=245
2430 A[I+135]=252
2440 N[I]=N[I+1]=50
2450 I=I+1
2460 A[I]=249
2470 A[I+45]=255
2480 A[I+90]=A[I+135]=19
2481 I=I+1
2483 REM THE TOTAL NUMBER OF CONSTRAINTS TO BE IMPLIMENTED IN THE NEXT PROGRAM
2484 REM IS DETERMINED BY ANSWERING THE FOLLOWING QUESTION AND CONSEQUENTLY
2485 REM INPUTTING THE NUMBER OF CONSTRAINTS INTO F4.
2488 REM
2490 DISP "HOW MANY CONSTRAINTS DO YOU WANT";
2500 INPUT F4
2502 REM
2503 REM THE LINK COMMAND LOADS THE NEXT PROGRAM WHILE RETAINING THE PREVIOUSLY
2504 REM INTRODUCED AND INITIALIZED VARIABLES....
2505 REM
2510 LINK 3
```

```
100 B1=I-1
102 REM
103 REM B1 DETERMINES HOW MANY BITS OF DATA HAVE BEEN INITIALIZED INTO THE A
105 REM MATRIX......
106 REM
107 REM THE N$ IS THE UNITS STRING, USED WITH THE LABELING STRING, M$.
108 REM
110 A3=0
111 N$="(KFT)(NM) (DEG)(KTS)(KHZ)(FT) (PSF)(SEC)(G)  DATE     #   "
120 M$[1,66]="MISSIONTITLEFTRMSL #L ALTL MACHL VELL HDGL RNGER RATET ALTT MACHT
130 M$[67,128]="VELT HDGT TYPEAUG/ECMTCARSPLOOK ANGL MODELDYN PRESSMSL FLT TIM'
140 M$[129,187]="EG BIASH BIASG0ATC TIMEMISS DISTACT FREQSTA NOFTS ACTIVRMBT"
150 M$[188,244]="ITL RETURNATIARM PULSEC PULSEF PULSETYPE FUZEOBJ ACHIEVED"
155 M$[245]="COMMENT"
156 IF F4=0 THEN 200
157 REM
158 REM IF NO CONSTRAINTS WERE DESIRED, NO INSTRUCTIONS WILL BE PRINTED OUT
159 REM
160 Z$[1,67]="PRESS (STOP), THEN ENTER YOUR CONSTAINTS IN LINE(S) 450,470,490,51
170 Z$[LEN(Z$)+1]="0,530,550,570"
180 Z$[52+4*F4]="; THEN PRESS (CONT),(2),(0),(0),(EXECUTE)"
190 PRINT Z$[1,72],Z$[73,LEN(Z$)]
195 WAIT 23000
200 A1=4
220 LOAD  DATA 4
230 K=0
231 REM
232 REM THE FOLLOWING LINES ARE USED WHEN FOUR OR LESS GOOD DATA STRINGS ARE
233 REM AVAILABLE AFTER ALL THE DATA FILES HAVE BEEN SEARCHED....
234 REM
240 I=K
241 IF H$[1,3]#"ZIP" THEN 250
242 GOTO K+1 OF 243,244,245,246
243 GOTO 1295
244 X$=W$[256,255]
245 Y$=W$[256,255]
246 Z$=W$[256,255]
247 A3=1
248 GOTO 870
250 N=0
251 REM
252 REM N IS THE COUNTER USED TO INITIALIZE THE WORKING STRING TO EACH DATA
253 REM STRING TO BE INSPECTED (WHEN USING CONSTRAINTS)......
254 REM
260 N=N+1
265 GOTO N OF 270,290,310,330,350,370,390,410
270 Z$=A$
280 GOTO 420
290 Z$=B$
300 GOTO 420
310 Z$=C$
320 GOTO 420
330 Z$=D$
340 GOTO 420
350 Z$=E$
360 GOTO 420
370 Z$=F$
380 GOTO 420
390 Z$=G$
400 GOTO 420
```

```
410 Z$=H$
420 IF N>8 THEN 1000
421 REM
422 REM THE NEXT FEW LINES INSPECT THE WORKING STRING VIA THE CONSTRAINT
423 REM (IF) STATEMENTS......
424 REM
425 FOR J=1 TO F4
440 GOTO J OF 450,470,490,510,530,550,570
450 IF Z$[21,26]>="24.321" THEN 580
460 GOTO 260
470 IF VAL(Z$[195,201]) >= 23 THEN 580
480 GOTO 260
490 IF Z$#"CONSTRAINT" THEN 580
500 GOTO 260
510 IF Z$#"CONSTAINT" THEN 580
520 GOTO 260
530 IF Z$#"CONSTRAINT" THEN 580
540 GOTO 260
550 IF Z$#"CONSTRAINT" THEN 580
560 GOTO 260
570 IF Z$#"CONSTRAINT" THEN 580
575 GOTO 260
580 NEXT J
585 IF Z$=Z$[256,255] THEN 260
590 I=I+1
600 B[I]=N
610 IF I#4 THEN 1000
620 I=0
621 REM
622 REM THE FOLLOWING LINES PUT THE KNOWN GOOD DATA STRINGS INTO THE STRINGS
623 REM USED IN THE PRINT STATEMENT..
624 REM
630 FOR J=1+K TO 4
640 GOTO B[J] OF 650,670,690,710,730,750,770,790
650 Z$=A$
660 GOTO 800
670 Z$=B$
680 GOTO 800
690 Z$=C$
700 GOTO 800
710 Z$=D$
720 GOTO 800
730 Z$=E$
740 GOTO 800
750 Z$=F$
760 GOTO 800
770 Z$=G$
780 GOTO 800
790 Z$=H$
800 GOTO J OF 810,830,850,860
810 W$=Z$
820 GOTO 860
830 X$=Z$
840 GOTO 860
850 Y$=Z$
860 NEXT J
865 K=0
866 REM
867 REM GOOD DATA STRINGS ARE PRINTED OUT VIA THE FOLLOWING COMMANDS....
868 REM
870 PRINT
```

```
880 PRINT
890 PRINT
900 FOR J=1 TO B1
910 F5=0.5*(11+A[J]-A[J+45])
920 F6=16+F5
930 F7=30+F5
940 F8=44+F5
950 F9=58+F5
960 PRINT M$[A[J+90],A[J+135]];N$[N[J],N[J]+4];TABF6;W$[A[J],A[J+45]];TABF7;
970 PRINT X$[A[J],A[J+45]];TABF8;Y$[A[J],A[J+45]];TABF9;Z$[A[J],A[J+45]]
980 PRINT
990 NEXT J
995 IF A3=1 THEN 1295
1000 IF N<8 THEN 260
1010 FOR J=K+1 TO I
1011 REM
1012 REM THE REMAINING GOOD DATA STRINGS (LESS THAN FOUR) ARE STORED IN STRINGS
1013 REM W,X,Y AND THE NEXT DATA FILE IS LOADED....
1015 REM
1020 GOTO B[J] OF 1030,1050,1070,1090,1110,1130,1150,1170
1030 Z$=A$
1040 GOTO 1180
1050 Z$=B$
1060 GOTO 1180
1070 Z$=C$
1080 GOTO 1180
1090 Z$=D$
1100 GOTO 1180
1110 Z$=E$
1120 GOTO 1180
1130 Z$=F$
1140 GOTO 1180
1150 Z$=G$
1160 GOTO 1180
1170 Z$=H$
1180 GOTO J OF 1190,1210,1230
1190 W$=Z$
1200 GOTO 1240
1210 X$=Z$
1220 GOTO 1240
1230 Y$=Z$
1240 NEXT J
1250 K=I
1260 A1=A1+1
1280 LOAD  DATA A1
1290 GOTO 241
1295 DISP "RELOAD FILE 1 FOR DIFFERENT DATA"
1300 END
```

APPENDIX E

SAMPLE DATA AQUISITION

```
RUN
DO YOU WANT ALL OF THE DATA?YES
HOW MANY CONSTRAINTS DO YOU WANT?0
```

MISSION DATE	01/01/75	01/02/75	01/03/75	01/04/75
TITLE	NTE #6A	NTE #6B	PVL-8	OPEVAL-1
FTR	F-14#606	F-14#606	F-14#631	F-14#901
MSL #	17172A	17171B	80553	98765
L ALT(KFT)	16.70	17.20	27.31	31.89
L MACH #	.615	.623	.873	1.10
L VEL(KTS)	583.	585.	854.	879.
L HDG(DEG)	172.1	187.2	54.51	40.32
L RNGE(NM)	15.01	11.20	15.73	21.84
R RATE(KHZ)	+60.1	+59.3	-23.6	35.42
R RATE(KTS)	-998.	-987.	756.0	-120.
T ALT(KFT)	14.95	14.83	33.67	34.57
T MACH #	.570	.580	.762	1.07
T VEL(KTS)	495.	502.	780.	854.
T HDG(DEG)	352.1	355.2	145.0	41.17
T TYPE	BQM-34A	BQM-34A	BQM-34E	BQM-34E
AUG/ECM	UNAUGMENTED	UNAUGMENTED	AUG 1.5 SQM	UNAUGMENTED
TCA(DEG)	180.0	177.0	90.15	.740
ASP(DEG)	2.000	06.00	61.88	1.20
LOOK ANG(DEG)	2.1L/1.8DN	05.1R/2.9DN	10.0L/3.5UP	.54R/2.13UP
L MODE	TWS SD/A	NORMAL ACTIVE	PDSTT S/A	TWS SD/A
LDYN/PRESS(PSF)	366.	36.2	370.	11.1
MSL FLT TIME(SEC)	84.51	65.21	18.71	41.14
G BIAS(G)	-6.25	-2.0	-2	0.0
H BIAS(G)	-1	0.	-1	0.
C0	0.0	0.0	-1	0.00
ATC TIME(SEC)	32.54	NOR/A	N/A	
MISS DIST(FT)	D/H	D/H	7.24	140.
ACT FREQ	-3	-4	-6	
STA NO	1	3	4	7

FTS ACTIV	N/A	N/A	N/A	N/A
RMBT(SEC)	15.8	16.1	25.2	39.2
ITL RETURN(SEC)	39.15	38.22	15.42	.....
ATI(SEC)	41.33	39.45	16.17	.NO..
ARM PULSE(SEC)	27.63	33.71	17.41	.....
C PULSE(SEC)	84.00	65.00	18.235421	TELEMETRY
F PULSE(SEC)	84.47	65.31	18.957798	....
TYPE FUZE	MK-454	MK-454	MK-747	..DATA..
	DOD 3600	DOD 9800	DOD 3100	....
OBJ ACHIEVED	YES	YES	YES	NO!
COMMENT	CLN HEAD	CLN HEAD	TM DROP-	FAIL-2 G
	ON D/H	ON D/H	PED OUT	TURN-IN

MISSION DATE	01/05/75	01/06/75
TITLE	OPEVAL-3	NFV-7, VX-4
FTR	F-14	F-14#636
MSL #	60606	72738
L ALT(KFT)	37.12	12.70
L MACH #	.678	.480
L VEL(KTS)	542.	372.
L HDG(DEG)	12.61	24.48
L RNGE(NM)	42.77	8.21
R RATE(KHZ)	40.71	-.021
R RATE(KTS)	-888.	12.10
T ALT(KFT)	6.252	13.01
T MACH #	.877	.465
T VEL(KTS)	527.	360.
T HDG(DEG)	45.37	25.51
T TYPE	HARPOON	BQM-34A
AUG/ECM	AUG 7. SQM	ECM (NOISE)
TCR(DEG)	32.77	0.0
ASP(DEG)	35.01	0.0
LOOK ANG(DEG)	21RT/6.5DN	0.0RT/.58UP
L MODE	PDSTT	PDSTT
	SEMI ACTV	SEMI ACTV
LDYN PRESS(PSF)	402.	720.
MSL FLT TIME(SEC)	81.71	39.21
G BIAS(G)	-6	+6.00
H BIAS(G)	-2	0.
G0	-1	0.00
ATC TIME(SEC)	N/A	N/A
MISS DIST(FT)	D/H	D/H
ACT FREQ		-4
STA NO	6	4
FTS ACTIV	N/A	N/A
RMBT(SEC)	37.2	21.0
ITL RETURN(SEC)	43.21	22.73

ATI(SEC)	47.62	23.03
ARM PULSE(SEC)	44.37	31.77
C PULSE(SEC)	80.35	39.257
F PULSE(SEC)	92.06	39.277
TYPE FUZE	MK-747	MK-1414
	DOD 1600	COD 1320
OBJ ACHIEVED	YES	YES
COMMENT	GUIDED	HT TRAIL
	S/A,D/H	TARGET

RELOAD FILE 1 FOR DIFFERENT DATA

```
LOAD1
RUN
DO YOU WANT ALL OF THE DATA?NO
DO YOU WANT MISSILE DATA?YES
DO YOU WANT TARGET DATA AT LTE?YS
DO YOU WANT RELATIVE DATA AT LTE?YS
DO YOU WANT MISSILE PARAMETERS?NO
DO YOU WANT ANY OF THE FUSE FUNC?NO
DO YOU WANT CONCLUSION/COMMENTS?YS
HOW MANY CONSTRAINTS DO YOU WANT?1
PRESS (STOP), THEN ENTER YOUR CONSTRAINTS IN LINE(S) 450; THEN PRESS (CON
T),(2),(0),(0),(EXECUTE)

FETCH450
450 IF Z$[33,37]="27.31"  THEN 500
CONT200
```

MISSION DATE	01/03/75	01/04/75	01/05/75
TITLE	PVL-8	OPEVAL-1	OPEVAL-3
FTR	F-14#631	F-14#901	F-14
MSL #	80553	98765	60606
L ALT(KFT)	27.31	31.89	37.12
L MACH #	.873	1.10	.678
L VEL(KTS)	854.	879.	542.
L HDG(DEG)	54.51	40.32	12.61
L RNGE(NM)	15.73	21.84	42.77
R RATE(KHZ)	-23.6	35.42	40.71
R RATE(KTS)	756.0	-120.	-888.
T ALT(KFT)	33.67	34.57	6.252
T MACH #	.762	1.07	.877
T VEL(KTS)	780.	854.	527.
T HDG(DEG)	145.0	41.17	45.37
T TYPE	BQM-34E	BQM-34E	HARPOON
AUG/ECM	AUG 1.5 SQM	UNAUGMENTED	AUG 7. SQM
TCA(DEG)	90.15	.740	32.77
ASP(DEG)	61.88	1.20	35.01
LOOK ANG(DEG)	10.0L/3.5UP	.54R/2.13UP	21RT/6.5DN
OBJ ACHIEVED	YES	NO!	YES
COMMENT	TM DROP-	FAIL-2 G	GUIDED
	PED OUT	TURN-IN	S/A,D/H

RELOAD FILE 1 FOR DIFFERENT DATA

```
LOAD1
RUN
DO YOU WANT ALL OF THE DATA?NO
DO YOU WANT MISSILE DATA?NO
DO YOU WANT TARGET DATA AT LTE?NO
DO YOU WANT RELATIVE DATA AT LTE?NO
DO YOU WANT MISSILE PARAMETERS?NO
DO YOU WANT ANY OF THE FUSE FUNC?NO
DO YOU WANT CONCLUSION/COMMENTS?NO
HOW MANY CONSTRAINTS DO YOU WANT?0


MISSION DATE      01/01/75     01/02/75     01/03/75     01/04/75

TITLE             NTE #6A      NTE #6B      PVL-8        OPEVAL-1

FTR               F-14#606     F-14#606     F-14#631     F-14#901

MSL #              17172A       17171B       80553        98765



MISSION DATE      01/05/75     01/06/75

TITLE             OPEVAL-3     NFV-7,VX-4

FTR               F-14         F-14#626

MSL #              60606        72738

RELOAD FILE 1 FOR DIFFERENT DATA
```

APPENDIX F

FLIGHT TEST PLAN AND FINAL REPORT

NAVAL MISSILE CENTER
Point Mugu, Calif. 93042

N213
8810

From: Commanding Officer, Naval Missile Center
To: Commander, Naval Air Systems Command (AIR-5105D)

Subj: Naval Missile Center Test Plan for AIM-54A Missile Performance Verification Launches (PVL) 14, 15, 16, 17, and 18; forwarding of

Ref: (a) Airtask No. A501-5014/054F/3501-000005

Encl: (1) Conf AIM-54A Performance Verification Launches Flight Test Plan for PVL-14, -15, -16, -17, -18

1. Five electronic countermeasure test launches have been designed as part of the AIM-54A Performance Verification Test established under reference (a). The plan for these launches is forwarded as enclosure (1).

G. C. GOOGINS
By direction

Copy to:
HUGHES AIRCRAFT CO. PT MUGU CA (2 w/encl)

Copy to:
N213A (2 w/encl)
N200 (w/o encl)
N210 (w/encl)
N120 (w/encl)
1623 (3, 2 w/o encl)
N213A (retain)

Prepared by:
M. BERGEN/hd
Ext. 8977/8028
25 February 1975

~~CONFIDENTIAL~~ UNCLASSIFIED mgb
UPON REMOVAL OF ENCLOSURE (1)

NAVAL MISSILE CENTER
FLIGHT TEST DIVISION

AIM-54A PERFORMANCE VERIFICATION LAUNCHES
FLIGHT TEST PLAN FOR PVL-14, -15, -16, -17, -18 (U)

27 FEBRUARY 1975

Prepared by: M. Bergen
MR. M. BERGEN

Submitted by: W. L. Dottle for
L. N. VESTAL, CDR, USN

Approved by: R C Clausing for
R. E. BOX, CDR, USN

Encl (1) to NAVMISCEN serial
C195 of 5 March 1975

CLASSIFIED BY NAVAIRINST 5511.4A
OF JANUARY 1971
EXCLUDED FROM GDS
DECLASSIFY ON 31 DECEMBER 1987

~~CONFIDENTIAL~~ mgb

N213A
8810

~~CONFIDENTIAL - UNCLASSIFIED UPON REMOVAL OF ENCLOSURE (1)~~ mgB

From: Commanding Officer, Naval Missile Center
To: Commander, Air Test and Evaluation Squadron FOUR

Subj: Naval Missile Center Test Results of OPEVAL AIM-54A Missile Firing E-4 Firing Report; forwarding of

Ref: (a) COMOPTEVFOR 023016Z APR 75
(b) NAVAIR Task Number A510-5102/054-F/4W-1627-0000

Encl: (1) (C) Naval Missile Center Test Results of OPEVAL AIM-54A Missile Firing E-4, Final Report

1. PHOENIX AIM-54A missile number 20024 was launched by Air Test and Evaluation Squadron FOUR on 27 March 1975 to satisfy the objectives of PHOENIX Operational Evaluation (OPEVAL) test E-4. The preliminary results were reported in reference (a). The Naval Missile Center detailed final report is forwarded as enclosure (1) in accordance with the technical support requirements for OPEVAL, as delineated in reference (b).

Internal copy to:
N213A (2 w/encl)
N200 (w/o encl)
N210 (w/encl)
N120 (w/encl)
N360 (w/encl)
1623 (3, 2 w/o encl)
N213A (retain)

Prepared by:
M. BERGEN/AS
EXT. 8977
23 April 1975

~~CONFIDENTIAL~~ mgB

NAVAL MISSILE CENTER
FLIGHT TEST DIVISION

TEST RESULTS
OPERATIONAL EVALUATION (OPEVAL)
OF PHOENIX AIM-54A
MISSILE FIRING E-4
FINAL REPORT

23 APRIL 1975

Prepared by: ______________________
MR. M. BERGEN

Submitted by: ______________________
D. E. COWLES, CDR, USN

Approved by: ______________________
D. T. SCHWAAB, CDR, USN

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APPENDIX G

FLIGHT TEST PLAN FORMAT

TEST PLAN FORMAT

Test plans may be composed of the below listed sections and sub-sections. Depending upon the complexity of the tests envolved all of the sub-sections may not be required. However, all sections are considered necessary, and all astricked sub-sections will be addressed.

Front Cover

Table of Contents

Key Personnel

I. INTRODUCTION

A. Background

- Contractors
- Previous Tests
- AIRTASKS *

B. Purpose of Test*

C. Chronology*

- Due dates
- Lead time requirements

II. SYSTEM DESCRIPTION

A. Description of Equipment to be Tested*

B. Operation of Equipment to be Tested*

III. TEST DESCRIPTION

A. Scope of the Test*

- Environmental requirements/restrictions
- Operational restrictions/limitations*
- Specification requirements*
- Specific questions to be answered*

B. Method of Test*

- Theory (where necessary)
- Test procedures
- Rationale for specific tests
- Test instrumentation/equipment
- Criteria for assessing data obtained in tests

(ALL SUBSEQUENT SUB-SECTIONS MUST BE ADDRESSED)

IV. CONDUCT OF TEST

A. Preflight and Operational Countdown

- Leadtime for flight/ground preparation
- Countdown
- Responsibility for preflight/checkout leading/arming etc

B. Operational Procedures (for apropos tests)

1. Launch Flights
   (a) No-go items
   - Switchology
   - Procedure
   - Safety
2. Captive Flights
   (a) No-go items
   - Swtichology
   - Procedure
   - Safety
3. Separation Flights
   (a) No-go items
   - Switchology
   - Procedure
   - Safety
4. Ground Tests
   - Switchology
   - Procuedure
   - Safety

C. Test Parameters

(Refer here to Appendices for mission profiles, etc.)

V. SUPPORT REQUIREMENTS

A. Personnel

B. Aircraft

- Type
- Loading
- Chase/Photo

C. Instrumentation

1. On Board
2. Telemetry
   - Format
   - Frequencies
   - Presentations required real time
3. Type data X, Y, Z accuracy required
4. Radar
5. Theodolite

D. Targets

1. Type
2. Configuration
   - Miss Distance Indicator
   - Photographs

E. Weapons

1. Type
   - Warhead
   - Telemetry Package
2. Hazard Safety requirements

F. Range Area

1. Range Safety Footprint
2. Weather
   - Minimums
   - Sun position
   - Sea state

G. Data Requirements

1. Specific Data Points Required
2. Acquisition
   - Flight Crew
   - Format
   - Data Reduction
3. Analysis
   - Responsibility
   - Support and Coordination
   - Charts, graphs, tables
4. Evaluation

Purpose of Test

This is a brief statement of the purpose of the project. The project directive questions which are to be answered as a result of the test will be stated clearly and concisely.

Chronology

The Chronology is the anticipated calendar history of the project. A Chronology should indicate major milestone dates such as:

a. AIRTASK/Job Order received.
b. The project aircraft and/or equipment received.
c. Instrumentation installed.
d. Flight test to commence.
e. Any anticipated prolonged delays (aircraft in PAR, for example).
f. All tests to be completed.
g. Report to be completed.

SYSTEM DESCRIPTION

Description of Equipment to be Tested

This sub-section should describe only the article tested, define differences between the test article and the item the test article represents (if possible) and pertain only to those items which are directly related to the evaluation.

This sub-section must include enough descriptive information to meet the needs of the reader who does not have ready access to handbooks or other similar material but excessively detailed description should be avoided.

Operation of Equipment to be Tested

This sub-section will be very similar to the preceeding sub-section but will deal with the operation of the test article vice the description of the article. All significant operation features will be addressed.

TEST DESCRIPTION

Scope of Tests

This section tells what tests are to be conducted and the limits of the test. If any restrictions on the test article or test vehicle have limited the scope, the restrictions should be included. If the restrictions are lengthy, they should be put in an appendix.

The Scope of Tests will include a list of the specification requirements against which the equipment is to be tested. If this list

VI. REPORTS

- Responsibility
- Type
- Distribution
- Due Date

FRONT COVER

The cover of the test plan will contain the title, the date, the names of the project officer and/or project engineer preparing the test plan, the Branch Head submitting the test plan and the Division Head approving the test plan, the security classification and the NAVMISCEN distribution. The title should be the same as that of the AIRTASK/Work Unit if the title meets the requirements for report titles; otherwise the report should be given a title which meets these requirements:

a. The nature of the project.
b. The equipment/weapon tested.
c. Significant limitation of the tests.

If possible, the title should be unclassified.

TABLE OF CONTENTS

A table of contents is required if the number of pages in the body of the test plan is greater than 15, but may be used in shorter test plans.

A table of contents normally lists all primary and secondary headings, begining with Key Personnel.

KEY PERSONNEL

The Key Personnel listed will be only the key personnel within the NAVMISCEN/Point Mugu complex. These personnel will be listed by military rank or by Mr., as appropriate. First names are normally not appropriate.

INTRODUCTION

Background

The background introduces the project to the reader. It should state as simply as possible how and why the project came into being, but must include the AIRTASK number and the Naval Missile Center Job Order Specifications.

APPENDIX H

FINAL LAUNCH REPORT FORMAT

REPORT FORMAT
FOR
REPORTING MISSILE FIRING

Letter of Transmittal

Title Page

Summary

Table of Contents (Optional)

I. INTRODUCTION

   A. Background

   B. Purpose of Test

II. TEST DESCRIPTION

   A. Scope of Test

   B. System Description

   C. Instrumentation

   D. Chronology

   E. Test Parameters (brief table)

III. TEST RESULTS AND DISCUSSION

   A. Preflight Testing

   B. Weapon System Performance

   C. Missile Receiver Performance

   D. Missile Guidance Performance

   E. Missile :uzing Performance

IV. CONCLUSIONS

APPENDICES

Letter of Transmittal

The letter will be short. It will give the missile number, the launch date, the launch agency, and the reporting agency (NAVMISCEN). It will reference the test plan, the initial message, and the NAVMISCEN task document.

Title Page

The cover of the report will contain the title, the date, the name(s) of the author(s), and the security classification.

Summary

The summary is a synopsis of the body of the report and should briefly state the launch agency, the basic test objectives, the elementary results, and if the objectives were achieved. If at all possible, it should be unclassified.

Table of Contents

The table of contents is not required, but if used, should contain a list of the major headings, the appendices and the references.

I. INTRODUCTION

Should provide the reader with all the background information on the program required to understand why the test was attempted and why we are reporting on it (ie, test objectives, air tasks, pertinent agencies, reporting objectives). This section should also reference the initial launch message or any other reporting pertinent to this test.

II. TEST DESCRIPTION

This section should provide a description of the weapon system, particularly any peculiarities or special modifications, the scope of the tests, any special instrumentation, pertinent dates relating

to preparation or conduct of the test, and the desired and actual test parameters (a brief table in the body of the report is appropriate).

III. TEST RESULTS AND DISCUSSION

This is the meat of the report and should contain all evidence leading to the conclusions. It should provide a complete analysis of the launch.

IV. CONCLUSIONS

This section provides a brief description of the complete test and results with conclusions and a statement of the completion of test objectives.

APPENDICES

The appendices should have a cover page which lists the contents. Each separate matrix or set of tables should be a separate appendix. The appendices must be referenced and used in the text, and should contain the detailed data which supports the text.